Stoller
Grand Junction Office established 1959

299-W18-15 (A4932)
Log Data Report

Borehole Information:

Borehole: 299-W18-15 (A4932)			**Site:** 216-U-10 Pond		
Coordinates (WA State Plane)		**GWL (ft)[1]:** 212.1		**GWL Date:**	10/9/2002
North	**East**	**Drill Date**	**TOC[2] Elevation**	**Total Depth (ft)**	**Type**
134,733.48 m	566,380.03 m	April 1980	202.22 m	248	Cable Tool

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Welded steel	1.3	8 5/8	8	5/16	0	248

The logging engineer measured the casing stickup using a steel tape. A caliper was used to determine the outside casing diameter. The caliper and inside casing diameter were measured using a steel tape, and measurements were rounded to the nearest 1/16 in. Casing thickness was calculated. Casing bottom is as reported from the well completion summary report (Ledgerwood 1993).

Borehole Notes:

Borehole coordinates, elevation, and well construction information, as shown in the above tables, are from measurements by Stoller field personnel and Ledgerwood (1993). The depths have been adjusted to TOC. Zero reference is the top of the 8-in. casing. Top of casing stickup is for the most part evenly cut. A reference point survey "X" is located on top of the casing stickup. A surface seal of grout extends to 20 ft (Ledgerwood 1993).

Logging Equipment Information:

Logging System:	Gamma 2B		**Type:** SGLS (35%)
Calibration Date:	09/2002	**Calibration Reference:**	GJO-2002-287-TAR
		Logging Procedure:	MAC-HGLP 1.6.5, Rev. 0

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2	3	4	5 / Repeat
Date	10/08/02	10/09/02	10/10/02	10/14/02	10/14/02
Logging Engineer	Spatz	Spatz	Spatz	Spatz	Spatz
Start Depth (ft)	1.5	58.0	240.0	141.0	35.0
Finish Depth (ft)	15.0	14.0	140.0	57.0	21.0
Count Time (sec)	100	100	100	100	100
Live/Real	R	R	R	R	R
Shield (Y/N)	N/A[3]	N/A	N/A	N/A	None
MSA Interval (ft)	0.5	0.5	0.5	0.5	1.0
ft/min	N/A	N/A	N/A	N/A	N/A
Pre-Verification	BB148CAB	BB150CAB	BB151CAB	BB152CAB	BB152CAB
Start File	BB149000	BB150000	BB151000	BB152000	BB152169

Log Run	1	2	3	4	5 / Repeat
Finish File	BB149027	BB150088	BB151200	BB152168	BB152197
Post-Verification	BB149CAA	BB150CAA	BB151CAA	BB152CAA	BB152CAA
Depth Return Error (in.)	0	0	-2	0	0
Comments	No fine-gain adjustment.	No fine-gain adjustment.	No fine-gain adjustment.	Fine-gain adjustments made after files BB152142 and BB152156.	No fine-gain adjustment.

Log Run	6 / Repeat				
Date	10/15/02				
Logging Engineer	Spatz				
Start Depth (ft)	1.5				
Finish Depth (ft)	12.0				
Count Time (sec)	100				
Live/Real	R				
Shield (Y/N)	None				
MSA Interval (ft)	1.0				
ft/min	N/A				
Pre-Verification	BB153CAB				
Start File	BB153000				
Finish File	BB153021				
Post-Verification	BB153CAA				
Depth Return Error (in.)	0				
Comments	No fine-gain adjustment.				

Logging Operation Notes:

Zero reference was the top of the 8-in. casing. Logging was performed without a centralizer installed on the sonde. Pre- and post-survey verification measurements for the SGLS employed the Amersham KUT (^{40}K, ^{238}U, and ^{232}Th) verifier with serial number 082.

Analysis Notes:

Analyst:	Sobczyk	Date:	10/21/02	Reference:	GJO-HGLP 1.6.3, Rev. 0

SGLS pre-run and post-run verification spectra were collected at the beginning and end of each day. The verification spectra were all slightly above the control limit for the 609-keV full-width at half-maximum value. Two of the verification spectra (BB151CAA and BB153CAB) were slightly above the control limit for the 1460-keV full-width at half-maximum value. Two of the pre-run verification spectra (BB151CAB and BB152CAB) were slightly above the control limit for the 1460-keV peak counts per second (cps). The peak counts per second for the 2615-keV photopeak were markedly below the control limit for two verification spectra (BB152CAB and BB153CAA). The peak counts per second at the 609-keV, 1461-keV, and 2615-keV photopeaks on the post-run verification spectra as compared to the pre-run verification spectra for each day were generally lower and between 2 and 10 percent of one another. Examination of spectra indicates that the detector appears to have functioned normally during all of the logging runs, and the spectra are provisionally accepted, subject to further review and analysis.

Log spectra for the SGLS were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Verification spectra were used to determine the energy and resolution calibration for processing the data using APTEC SUPERVISOR. Concentrations were

calculated in EXCEL (source file: G2BSep02.xls), using parameters determined from analysis of recent calibration data. Zero reference was the top of the 8-in. casing. The casing configuration was assumed to be one string of 8-in. casing with a thickness of 0.322 in. to total logging depth (240 ft). A casing thickness of 0.322 in. is the published value for ASTM schedule-40 steel pipe (a commonly used casing material at Hanford). This casing thickness is within the range of measurement error associated with the measurement acquired by the logging engineer and agrees within 0.01 in. of the casing thickness used in processing the 1993 RLS log. A water correction was applied to the SGLS data below 212.1 ft. Dead time corrections are required when dead time exceeds 10.5 percent. As the dead time did not exceed 10.5 percent, a dead time correction was not needed or applied.

Log Plot Notes:

Separate log plots are provided for gross gamma and dead time, naturally occurring radionuclides (^{40}K, ^{238}U, and ^{232}Th), and man-made radionuclides. Plots of the repeat logs versus the original logs are included. In addition, a comparison log plot of man-made radionuclides is provided that compares data collected with Westinghouse Hanford Company's Radionuclide Logging System (RLS) with SGLS data. This plot is included to assess the possibility of contaminant movement in the vadose zone. For each radionuclide, the energy value of the spectral peak used for quantification is indicated. Unless otherwise noted, all radionuclides are plotted in picocuries per gram (pCi/g). The open circles indicate the minimum detectable level (MDL) for each radionuclide. Error bars on each plot represent error associated with counting statistics only and do not include errors associated with the inverse efficiency function, dead time correction, or casing correction. These errors are discussed in the calibration report. A combination plot is also included to facilitate correlation. The ^{214}Bi peak at 609 keV was used to determine the naturally occurring ^{238}U concentrations on the combination plot rather than the ^{214}Bi peak at 1764 keV because it exhibited slightly higher net counts per second.

Results and Interpretations:

^{137}Cs and ^{235}U were the man-made radionuclides detected in this borehole. ^{137}Cs was detected in two intervals: from 1.5 to 5.5 ft and from 26.5 to 30 ft. The maximum apparent activity was 4.3 pCi/g at a log depth of 2.5 ft. ^{137}Cs was also detected at 12.0, 13.5, and 161 ft with concentrations ranging from 0.3 to the MDL (0.2 pCi/g). ^{235}U was detected at 240 ft with an apparent concentration of 5 pCi/g, which was well above the MDL of 1 pCi/g. A 1001-keV photopeak, which is associated with the radioactive decay of processed ^{238}U, was also apparent at 240 ft. However, the APTEC software did not identify the 1001-keV photopeak as a statistically significant peak.

Comparison log plots of data collected in 1993 by Westinghouse Hanford Co. (WHC) and in 2002 by Stoller are included. The RLS concentration data for ^{137}Cs are decayed to the date of the SGLS logging event in October 2002. The SGLS and 1993 RLS logs appear to use a different depth reference, and the RLS logs were shifted 1.3 ft. Since 1993, ^{137}Cs activities appear to have decreased as predicted by radioactive decay. The 1993 RLS log did not report an indication of processed uranium at approximately 240 ft. The total logging depth of the RLS was 240.3 ft.

Recognizable changes in the KUT logs occurred in this borehole. Changes of about 5 pCi/g in apparent ^{40}K concentrations occur at approximately 21, 27, 121, 139, and 152 ft. The relatively low (less than 5 pCi/g) concentrations of ^{40}K above 21 ft are due to the surface grout. There is a 5-pCi/g decrease in ^{40}K concentrations from 100 to 110 ft. ^{238}U concentrations increase by approximately 1 pCi/g in the intervals between 21 and 27 ft and 175 and 178 ft. ^{232}Th increases by approximately 0.4 pCi/g or more in the intervals between 21 and 27 ft, 122 and 140 ft, and 175 and 178 ft. Between 122 and 140 ft, the fine-grained member of the Cold Creek Unit (formerly known as the Early Palouse Soil) is shown by an increase in total gamma (50 cps), ^{40}K (5 pCi/g), and ^{232}Th (0.4 pCi/g).

The plots of the repeat logs demonstrate reasonable repeatability of the SGLS data for both the man-made and natural radionuclides (661, 609, 1461, 1764, and 2614 keV).

References:

Ledgerwood, R.K., 1993. *Summaries of Well Construction Data and Field Observations for Existing 200-West Resource Protection Wells*, WHC-SD-ER-TI-005, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

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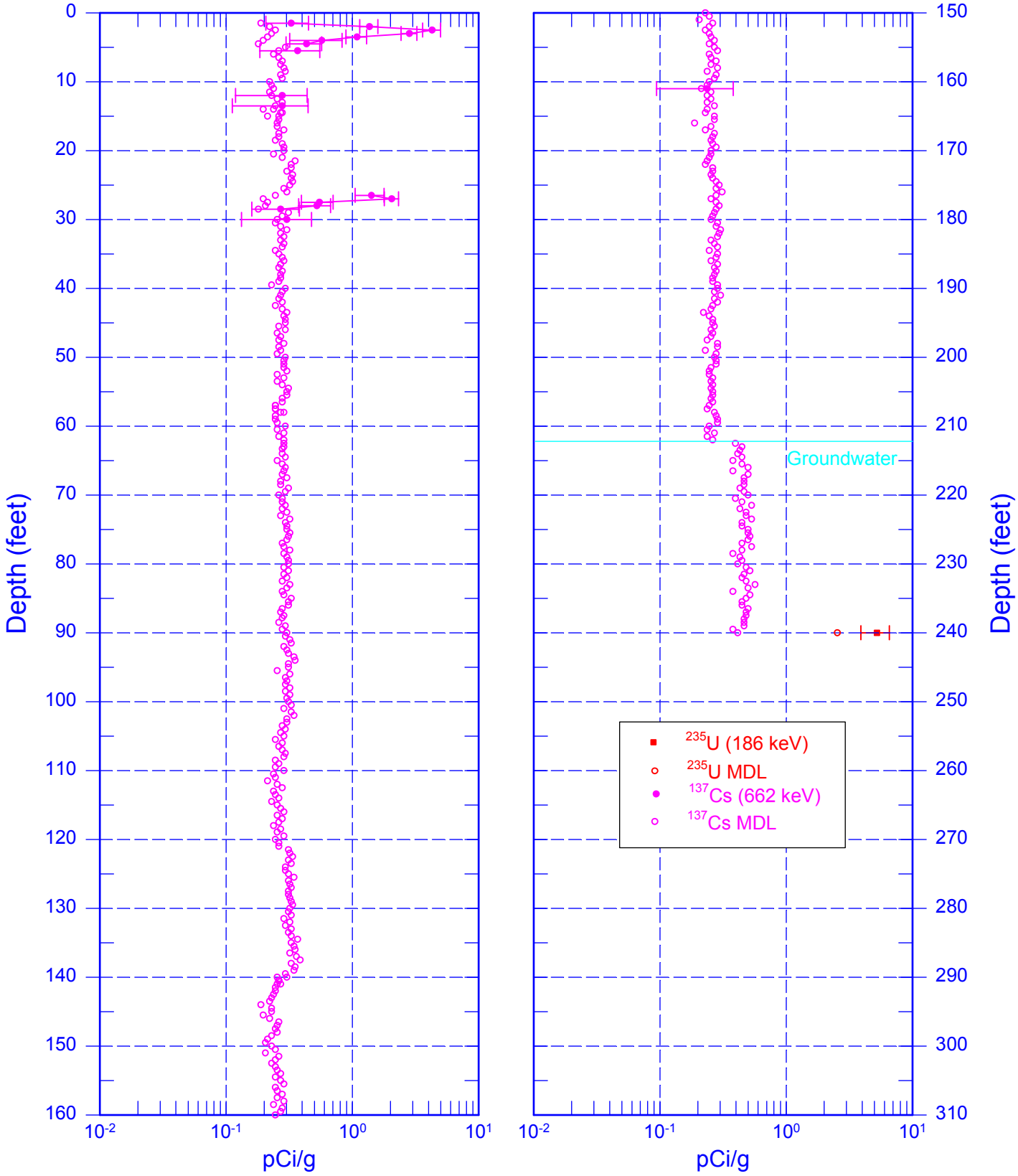
[1] GWL – groundwater level
[2] TOC – top of casing
[3] N/A – not applicable

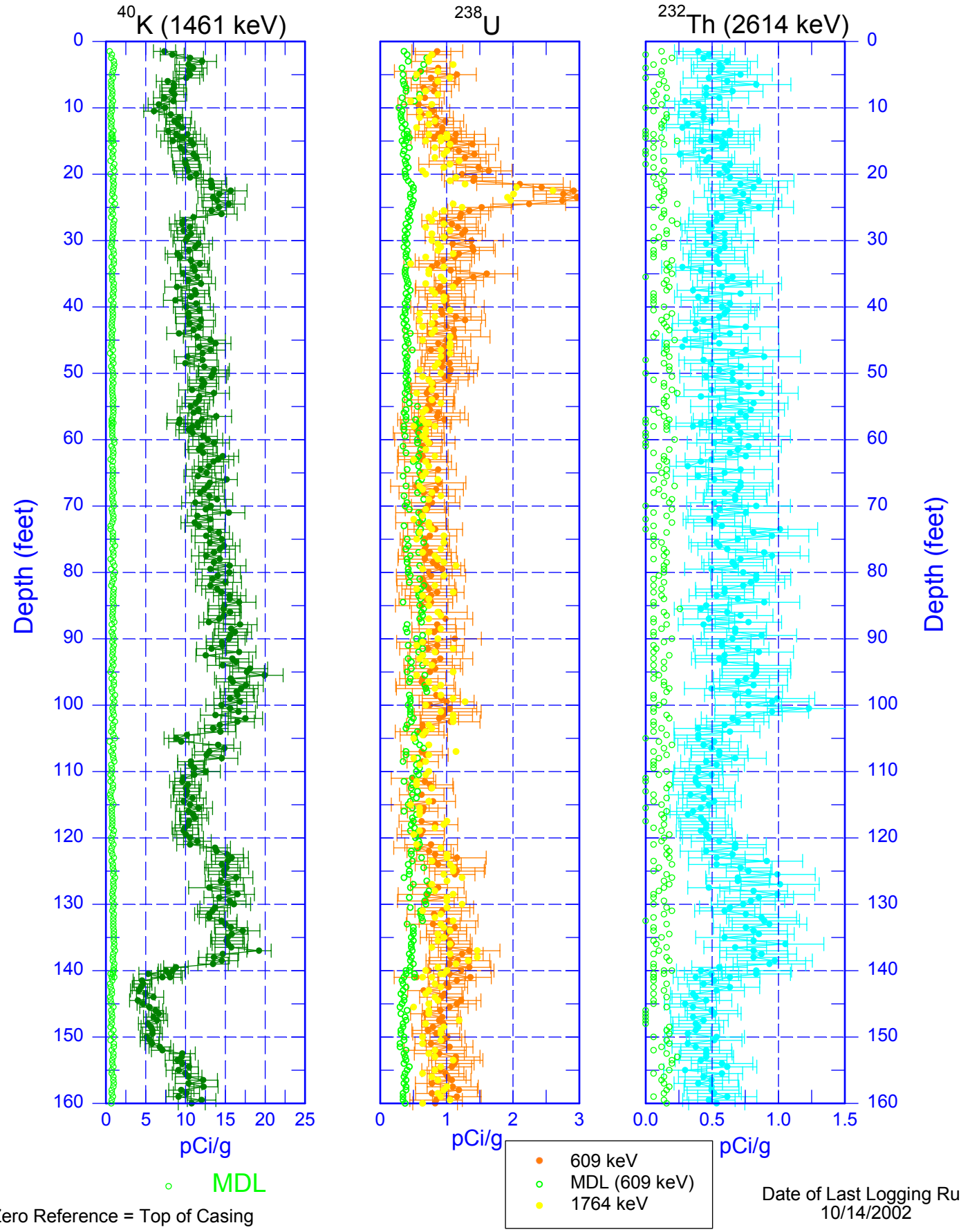
299-W18-15 (A4932)
Man-Made Radionuclides



Zero Reference = Top of Casing

Date of Last Logging Run
10/14/2002

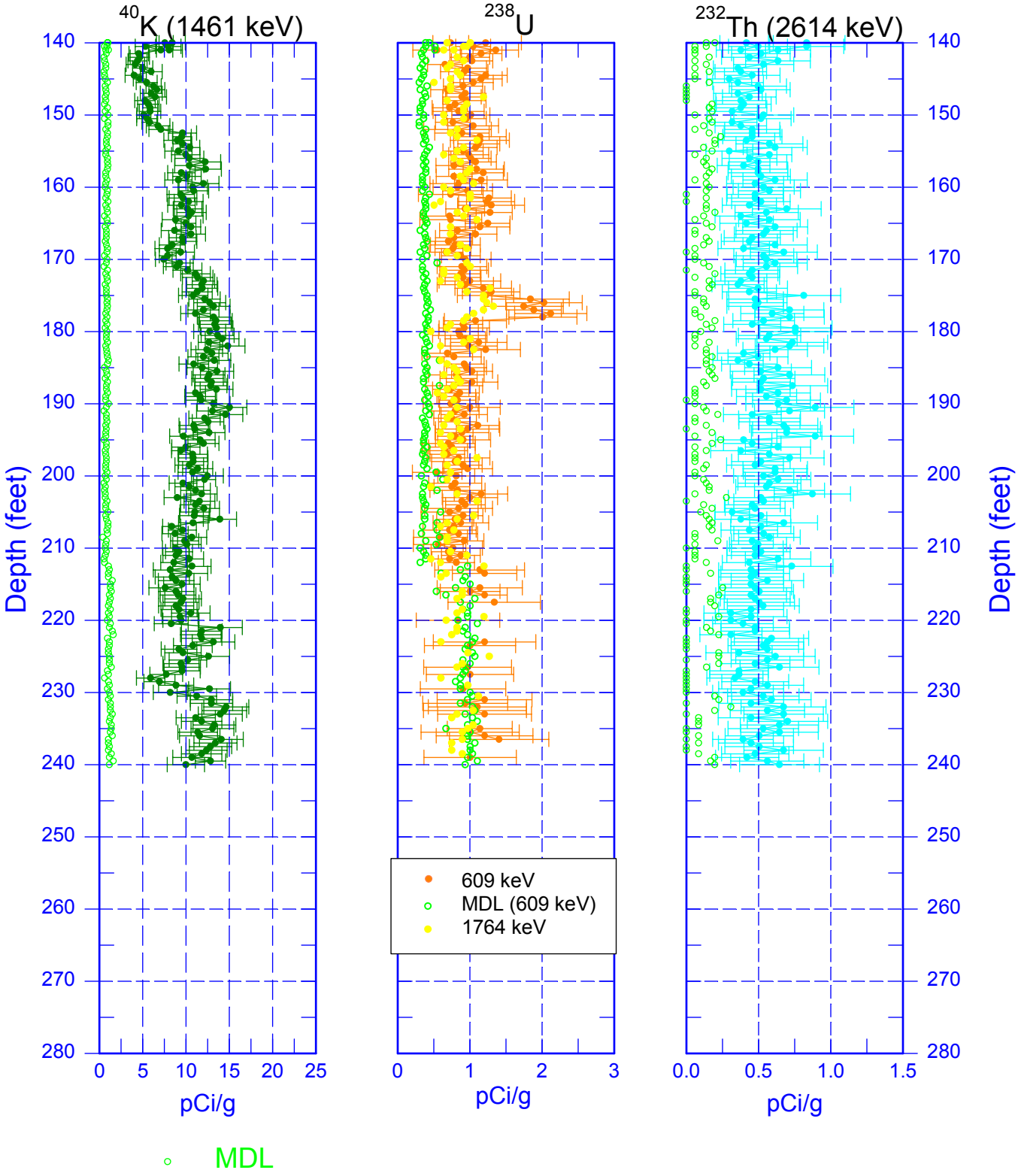
299-W18-15 (A4932)
Natural Gamma Logs



Zero Reference = Top of Casing

Date of Last Logging Run
10/14/2002

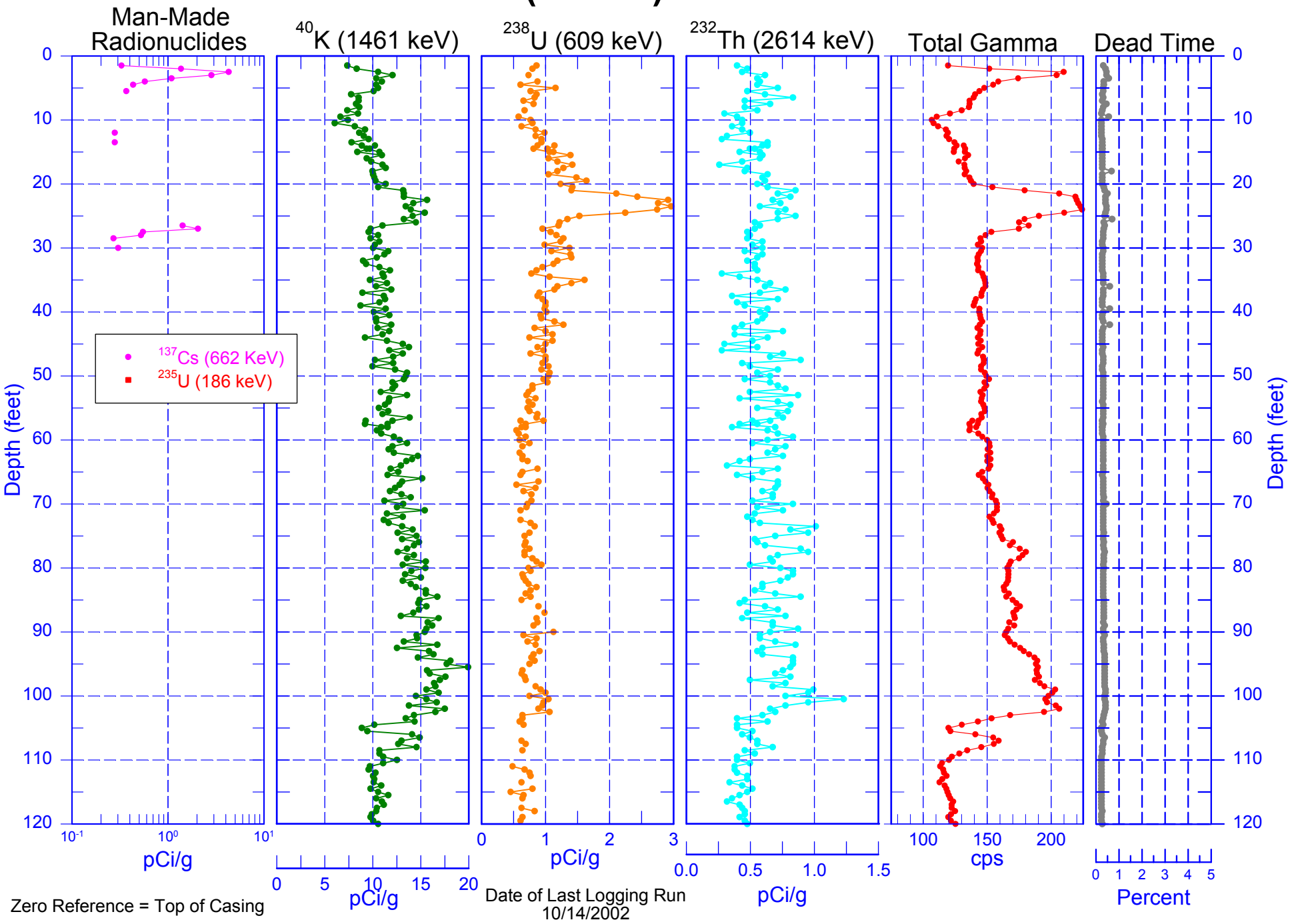
299-W18-15 (A4932)
Natural Gamma Logs



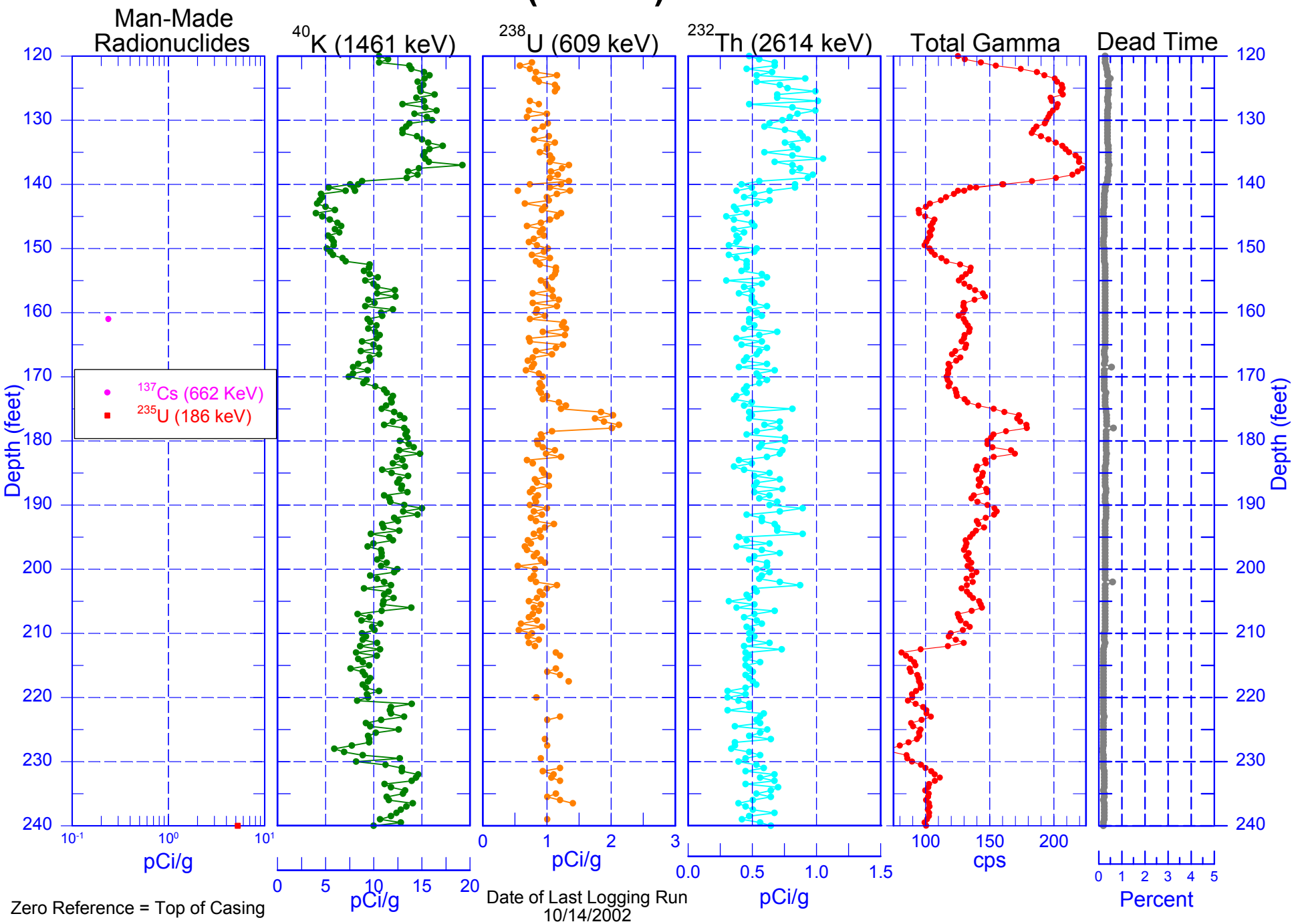
Zero Reference = Top of Casing

Date of Last Logging Run
10/14/2002

299-W18-15 (A4932) Combination Plot



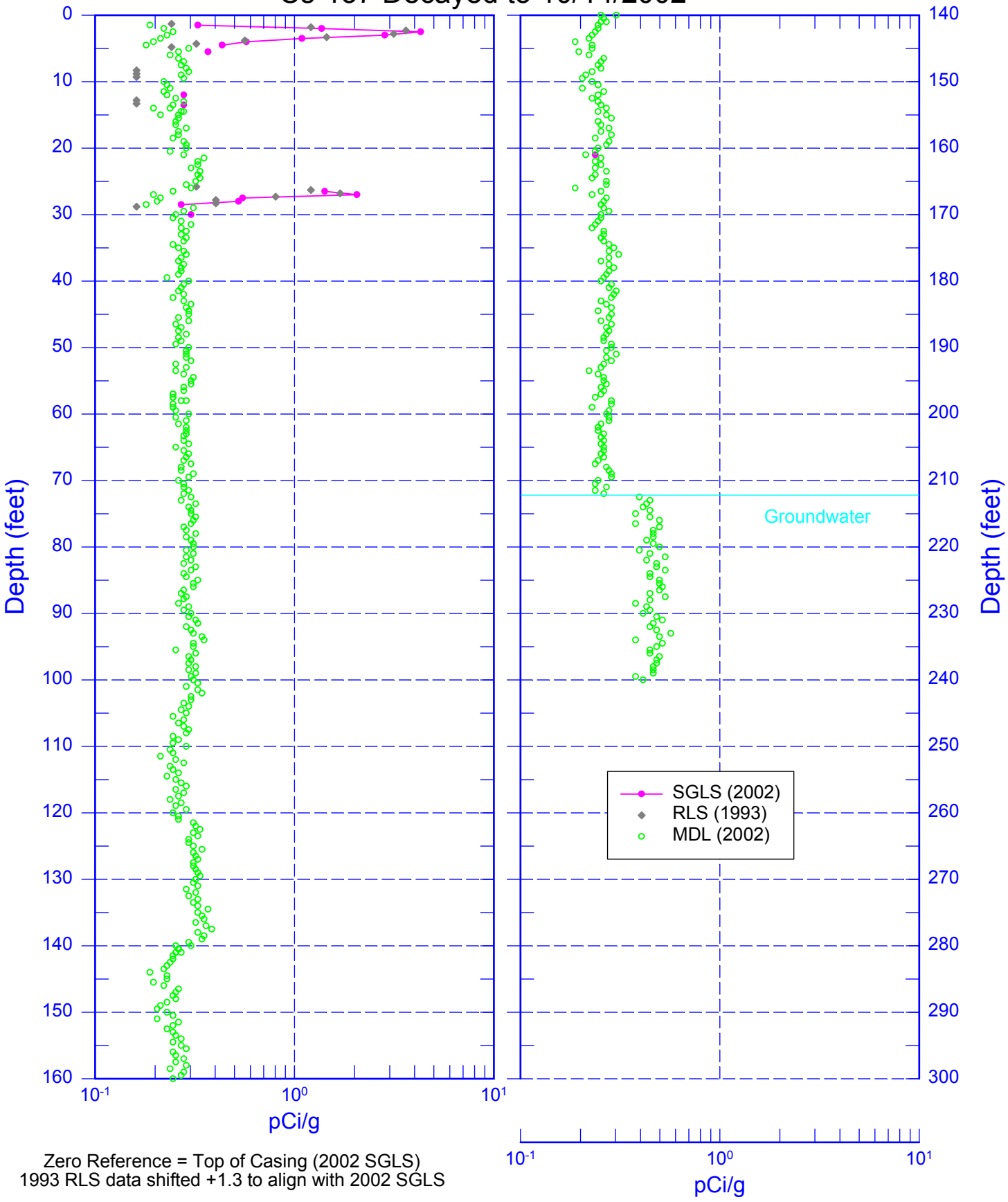
299-W18-15 (A4932) Combination Plot



299-W18-15 (A4932)

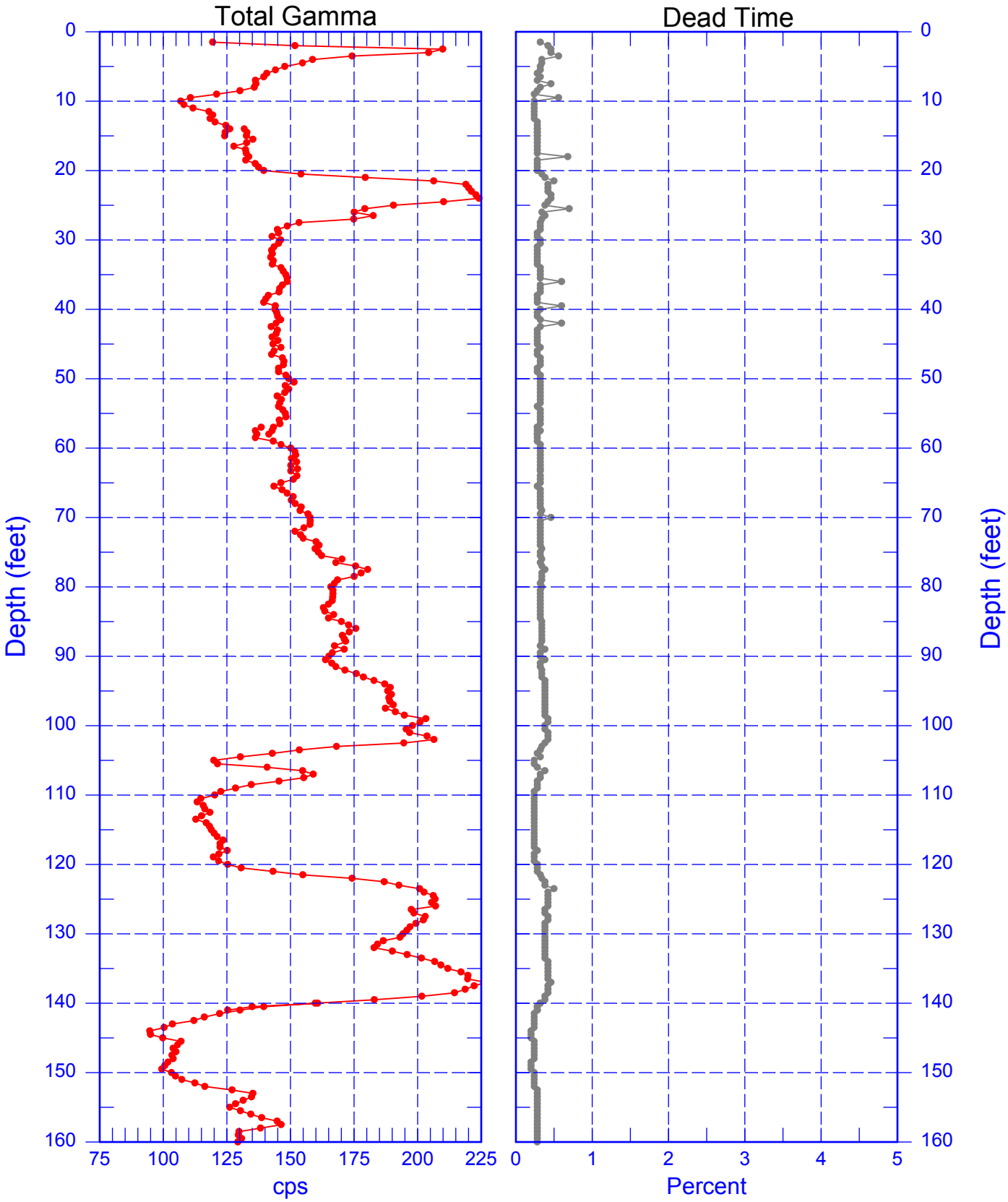
RLS Data Compared to SGLS Data

Cs-137 Decayed to 10/14/2002



Zero Reference = Top of Casing (2002 SGLS)
1993 RLS data shifted +1.3 to align with 2002 SGLS

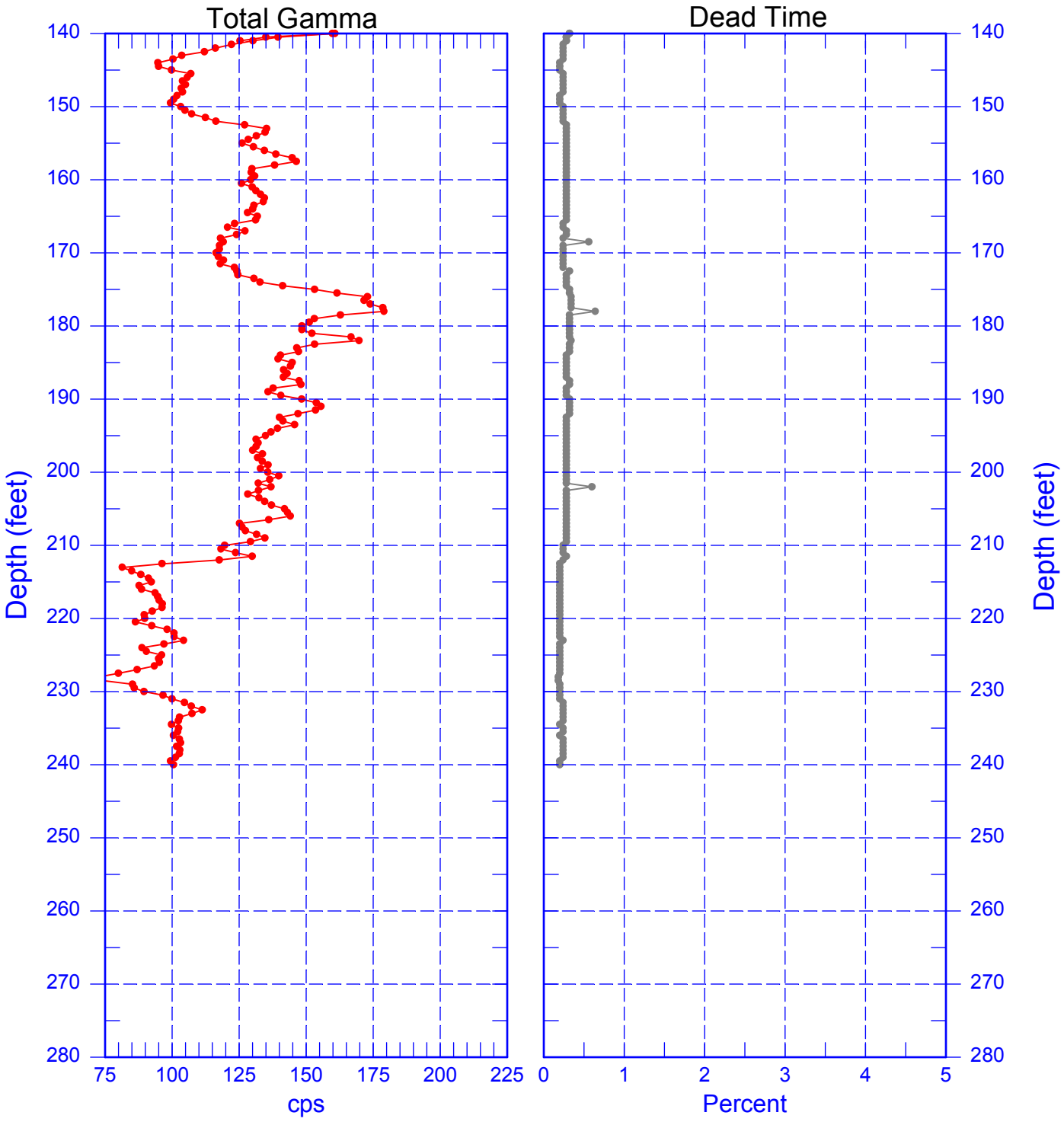
299-W18-15 (A4932)
Total Gamma & Dead Time



Date of Last Logging Run
10/14/2002

Zero Reference = Top of Casing

299-W18-15 (A4932)
Total Gamma & Dead Time

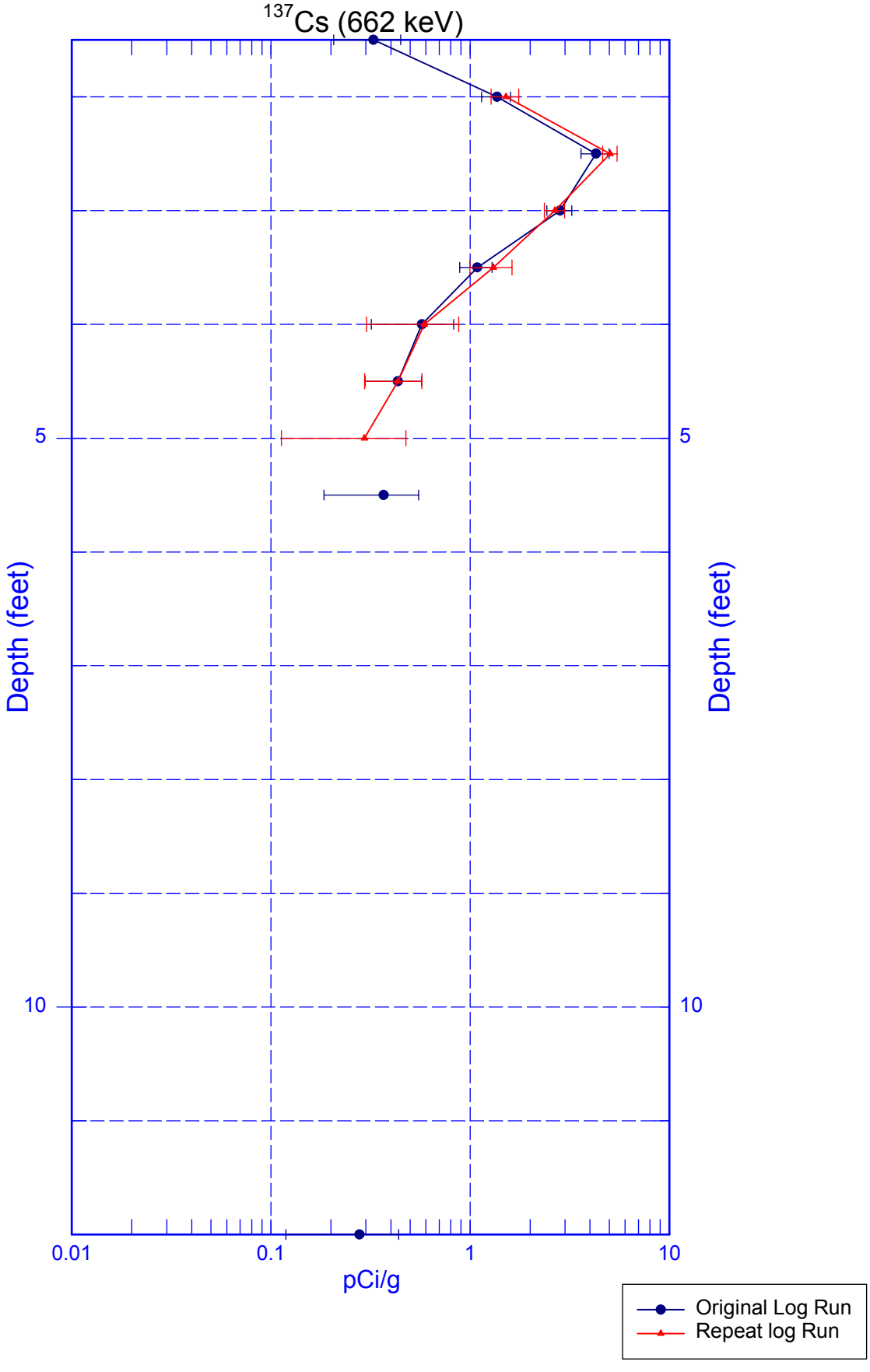


Zero Reference = Top of Casing

Date of Last Logging Run
10/14/2002

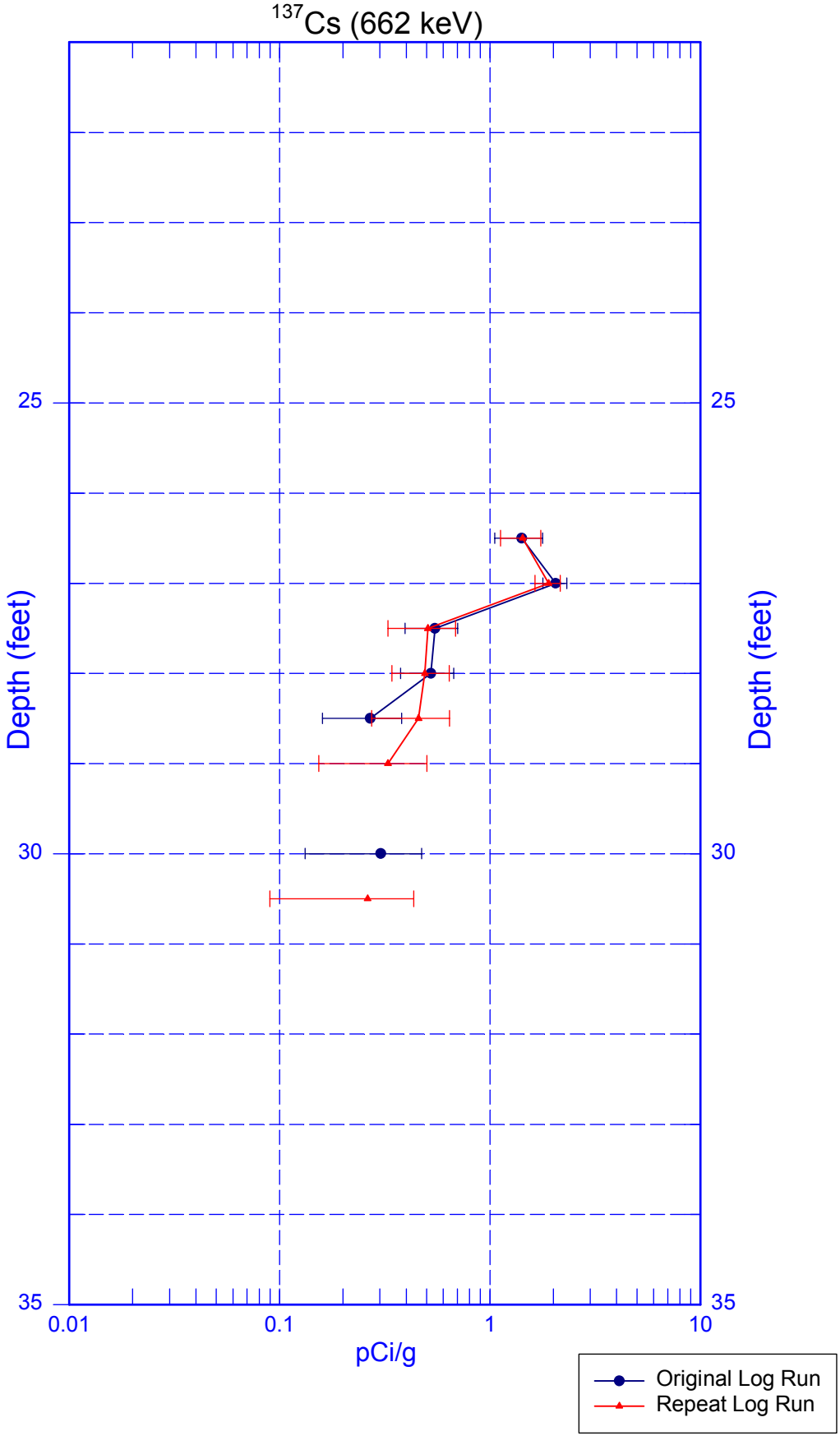
299-W18-15 (A4932)

Rerun of Man-Made Radionuclides (1.5 to 12.0 ft)



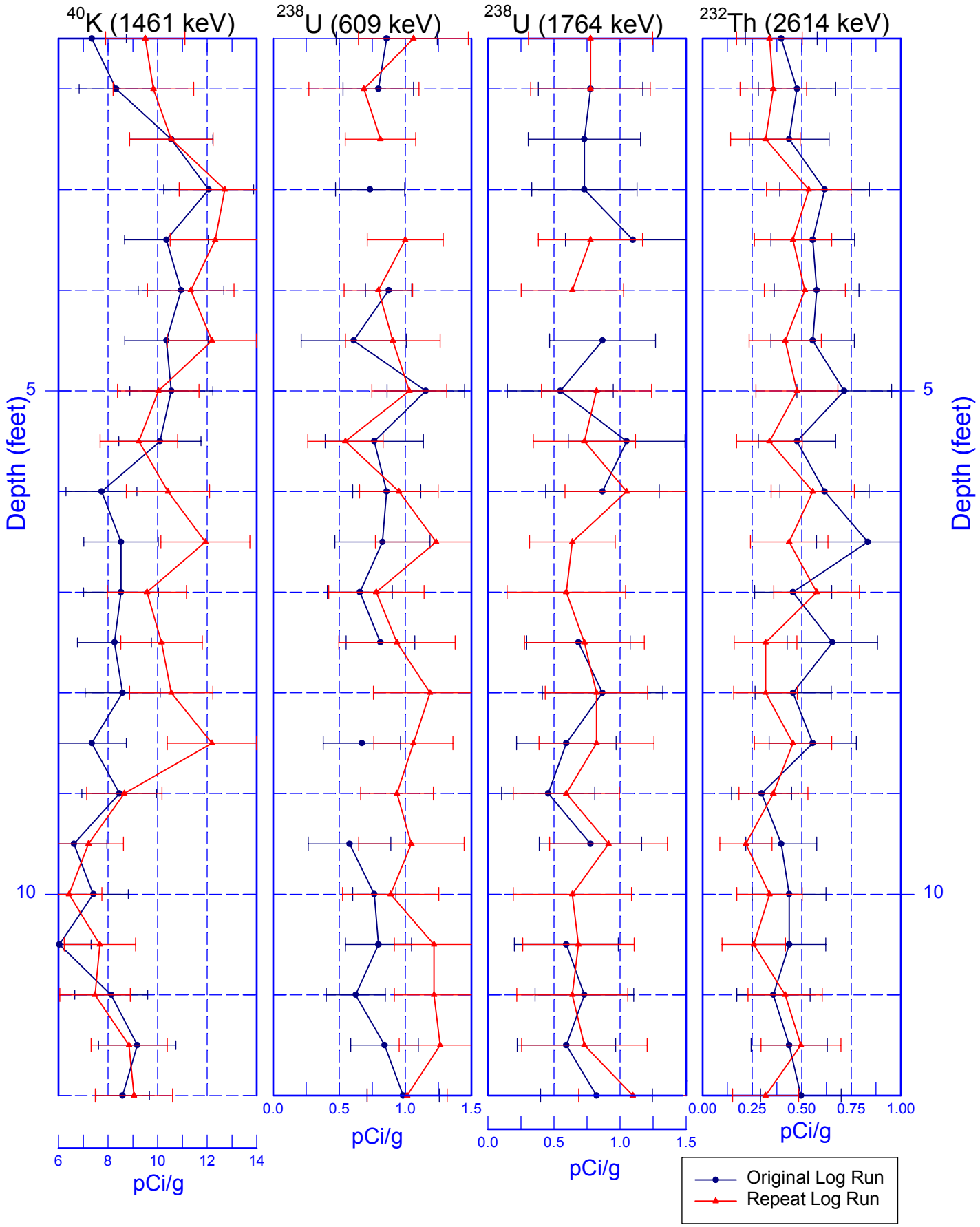
299-W18-15 (A4932)

Rerun of Man-Made Radionuclides (35.0 to 21.0 ft)



299-W18-15 (A4932)

Rerun of Natural Gamma Logs (1.5 to 12.0 ft)



299-W18-15 (A4932)

Rerun of Natural Gamma Logs (35.0 to 21.0 ft)